

**State of Wisconsin/Department of Transportation**  
RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: March 31, 2008

Program: SPR-0010(36) FFY99		Part: II Research and Development	
<b>Project Title:</b> Development of a Database Framework and Implementation Plan for Integrating WisDOT Materials and Construction Databases		<b>Project ID:</b> 0092-08-17	
<b>Administrative Contact:</b> Nikki Hatch		<b>Sponsor:</b> Wisconsin Depart. of Transportation	
<b>WisDOT Technical Contact:</b> Jim McDonnell		<b>Approved Starting Date:</b> 11/29/07	
<b>Approved by COR/Steering Committee:</b> \$79,994.05		<b>Original End Date:</b> 2/28/09	
<b>Project Investigator (agency &amp; contact):</b> Kelly L. Smith		<b>Current End Date:</b> 2/28/09	
		<b>Number of Extensions:</b> 0	

**Percent Complete:** 8%

**Request a No Cost Time Extension (Please Select One):** ☐ YES ☒ NO

**Reason for No Cost Time Extension:**

**Project Description:** Following are the research tasks:

- Task 1—Interview Researchers
- Task 2—Review WisDOT Databases and Determine Database Linkage Needs
- Task 3—Identify and Map Logical Relationships in Databases
- Task 4—Identify Database Integration Constraints
- Task 5—Suggest Revisions and Evaluate Methods for Linking Databases
- Task 6—Prioritize Database Integration Recommendations
- Task 7—Prepare Final Report and Technical Design Document

**Progress This Quarter:**

(Includes project committee mtgs, work plan status, contract status, significant progress, etc.)

This quarterly report covers the work performed since the start of the contract (Nov 29, 2007) through the close of the period (March 31, 2007). During this time, work has been focused on Tasks 1 and 2. Summaries of the progress and notable results of each task are provided below.

**Task 1—Interview Researchers**

To start this task, the project team compiled a list of researchers from academia, private consultants, and WisDOT, who were deemed to have substantial experience with WisDOT databases as part of their highway pavement studies. The team also developed a short electronic questionnaire to facilitate feedback from the researchers concerning the types of research performed, the databases used, issues encountered with the databases, and suggestions for improving them. The questionnaire was sent to the selected researchers by email and was generally followed up with either a phone call or further email correspondence, to ensure clear understanding of the questions and to elaborate on responses. A summary of the interviews conducted is provided below.

The project team collected very detailed information from Prof. Samuel Owusu-Ababio from the University of Wisconsin-Platteville. Dr. Owusu-Ababio is completing a relevant study with the Midwest Universities Transportation Research Center (MUTRC). The project shares similar goals as the current study in evaluating methods for performance modeling of flexible pavements, and entails integrating information from disparate databases. Significant efforts were made to identify semantic discrepancies both within and across databases and systematic methods to alleviate the problems were developed.

Dr. Owusu-Ababio's study reviewed Design, Construction, Meta-Manager, and Performance databases at WisDOT. He reports that the semantic discrepancies between the databases include the use of different field names or labels that represent the same information, inconsistent formats for data entry, and redundant fields for some databases.

The project identified file relations for each database. For the construction database, Test# is the key field for relating component files/datasheets. Likewise, for the design database AC Office and AC field, the contract information forms the link. The sequence number can be used to access the components of the Performance and Meta-manager databases. For integrating data across databases, other references had to be identified and are listed in detail in the project final report.

In the context of performance modeling, a critical component of Dr. Owusu-Ababio's study, performance indicators and factors that influence performance were identified and their availability (or lack thereof) within the WisDOT databases, was verified. The study also recognized the need for Location Referencing Indicators (LRI) in order to physically relate specific information from a database to the road network or segments LRI for each of the databases were established in this study. However, they were found to be limited in their ability to link with coordinate-based databases. The study suggests a shift towards global positioning system approach for determining location in the future.

Dr. Owusu-Ababio's study was funded with a budget of \$50,000. Although task related to the database was completed at the originally planned budget of \$22,745, it required a higher level of effort to overcome the challenges. The effort required was about 10 percent higher than anticipated. However, it was completed over a longer duration of time and required a contract period extension which was requested by the PI and granted by MUTRC.

Dr. Teresa Adams responded on behalf of the University of Wisconsin-Madison researchers and indicated there is an ongoing research project in the area of maintenance that uses the Pavement Information Files (PIF) database alone. She indicated there has been no issue of using the database by itself. For a previous project, she indicated that database quality and availability were concerns. Dr. Adam also mentioned that she worked on the data integration for WisDOT and published the proposed concept at TRB.

Finally, the team conducted a telephone interview with a group of WisDOT representatives closely tied to Wisconsin pavement research. These included Mr. Tom Brokaw, Mr. Mike Malaney, and Ms. Irene Bataglia. A few selected research projects were discussed, including the WHP project "Guidance, Parameters, and Recommendations for Rubblized Pavements." Mostly construction and performance data were the targets of the studies, with key database issues consisting of missing data, data discrepancies or inconsistencies (e.g., conflicting construction years or rehabilitation types/thicknesses), and difficulties linking specific project limits/locations. An estimate of the impact of database challenges on project budget and schedule was provided for one project (approximately double the cost allocated for data collection and assembly, and a delay of up to 6 months), and important points were made about the demands placed on WisDOT representatives in aiding the contracted researcher obtain and compile data. It was noted that their demands are often a function of project and researcher; in some cases, the time spent may be the time it takes to load data onto a CD or DVD, while in others a week or several weeks may be devoted to the data compilation effort. In general, projects involving new researchers and those requiring data from more than one data source result in greater demands placed on WisDOT representatives. This is due to the time spent educating and informing the researcher (often comprised of graduate students) about the databases and the considerable time needed to develop SAS data queries. Regarding the former, a suggestion was made for development of a Data Dictionary, describing the original specific purpose of each database and the specific data fields included in each. Other suggestions for improving database capabilities included issuing an annual contract to continually monitor and upgrade databases and to allow consultants to review electronic as-built construction plans.

## Task 2—Review WisDOT Databases and Determine Database Linkage Needs

To present and discuss in detail the project work plan with members of the project oversight committee (POC) and WHP staff, a kick-off meeting was held on February 19<sup>th</sup> at the UW Engineering Hall. In addition to firming up the researchers to be interviewed in task 1, a preliminary list of WisDOT databases (and their associated

administrators) to be reviewed by the project team as part of task 2 was discussed. The preliminary list was narrowed down to the following, which will be reviewed on site at WisDOT facilities:

Database/File(s)

- PIF, Layer & Base, NewCon Reports, Office All, PMDSS
- HMA Mix Design Database, Materials Tracking and Reporting Systems
- Meta-Manager
- Wisconsin Highway Traffic Volume
- DTD View
- Location Control Mgt
- State Trunk Highway Database, State Highway Deficiency File, Sect Descrip Proj

Because of the demands for time to be spent with database administrators, it was determined that arrangements for the on-site database reviews would need to be made internally by the WisDOT POC chairman. Arrangements/scheduling is in the process of being done, with the expectation that the reviews will occur in April.

**Work Next Quarter:**

In the upcoming quarter, the project team will complete the Task 1 researcher interviews and Task 2 database reviews, and begin assessing the overall connectivity of the databases and the ability of that connectivity to facilitate future research needs, given whatever constraints are identified (Tasks 3 and 4).

**Circumstances Affecting Progress/Budget:**

The project schedule has been delayed a little in the attempt to schedule the task 2 database reviews.

**Gantt Chart:**

RESEARCH TASK	2007			2008												2009				EST. % COMP.
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	
1. Interview Researchers																				
			25	100																80
2. Review WisDOT Databases & Determine WisDOT Database Linkage Needs				25	100															22
3. Identify & Map Logical Relationships in Databases					10	50	100													
4. Identify Database Integration Constraints							25	100												
5. Suggest Revisions & Evaluate Methods for Linking Databases									25	100										
6. Prioritize Database Integration Recommendations										25	50	100								
7. Prepare Final Report & Technical Design Document												10	40	80	80	80	100			
<b>OVERALL % COMPLETION</b>			1.9	12.7	29.3	34.1	42.0	47.5	50.2	61.0	63.9	72.7	81.8	93.9	93.9	93.9	100.0			10.6